

REMARKS

Claims 1-10 and 13-21 are pending in the application. Claims 1, 2, 5 and 14 have been amended to better describe the invention. Support for these amendments can be found throughout the specification and claims, as originally filed, and in particular in Claims 1, 2, 5 and 14. Claims 13 and 21 have been cancelled. The Applicants respectfully reserve their right to pursue the cancelled subject matter in a continuation or continuation-in-part application at a later date. Favorable consideration of the application as amended is respectfully requested.

As a preliminary matter, in the Office Action the Examiner maintained the rejection of Claims 1-10 and 13-21 in the previous Office Action dated November 28, 2007 under 35 U.S.C. §103(a) as allegedly being obvious over United States Patent No. 4,034,023 to Hardy Sr. et al. (hereinafter referred to as "Hardy") in view of United States Patent No. 3,931,367 to Giolito (hereinafter referred to as "Giolito"). In particular, while acknowledging that Hardy fails to teach a process of sparging the reaction medium with an inert carrier gas, the Examiner has nevertheless concluded that it would have been obvious to combine Hardy with Giolito, which allegedly teaches a process of making mixed phosphate esters wherein the reaction medium is sparged with an inert carrier gas to arrive at the present invention. However, as demonstrated below, even if one of ordinary skill in the art were to combine Hardy and Giolito in the manner suggested by the Examiner, one of ordinary skill would not arrive at the present invention.

In making the rejection, the Examiner mischaracterizes Hardy as disclosing "reacting the first reaction product with excess n-butanol at a

temperature 35°to about 150°C at 5 to 100mm Hg to prepare crude phosphate ester composing comprising tributyl phosphate, dibutyl phenyl phosphate and butyl diphenyl phosphate...” (Office Action dated November 28, 2007, p. 5).

However, a review of Hardy indicates that the temperature range recited for the second reaction is not 35°to about 150°C, but instead is below 35°C. In fact, Hardy clearly states that the reactants be “reacted in the cold, that is at a temperature below 35°C, during the entire reaction to prevent product loss due to acid hydrolysis.” (Hardy, Col.3, lines 6-9, emphasis added). Immediately following this section, Hardy then states the preferred reaction temperature as “15°C to 20°C . . . and maintained at about 20°C to 30°C until the reaction is complete.” Notably, the only place in Hardy where the temperature range of “50°C to 150°C” is recited is in the purification and drying of the product, *which occurs after the “reaction is complete.”* (Hardy, Col.3, lines 34-66).

In addition, the only other place where a temperature of above 100°C is discussed in the Hardy reference is at column 2, lines 10-41, which describes the reaction of phenol and phosphorus oxychloride to prepare crude phenyl and diphenyl phosphorodichloridate which is the starting materials of the presently claimed invention, not the product. Hardy then goes on to state that after this reaction the second reaction is conducted below 35°C. (See Col 3, Ins. 5-32)

In stark contrast, the process of the present invention, as claimed, is conducted at a temperature above 35°C, namely 60 to 200°C. As stated above, Hardy, which requires that the reaction be conducted at a temperature below 35°C, specifically teaches away from using a temperature above 35°C during the entire reaction to prevent product loss due to acid hydrolysis. Giolito does not

correct the factual deficiencies of Hardy. Indeed, even if Hardy is combined with Giolito, the claimed invention would not be obtained, as it would not result in a process which is conducted at a temperature above 35°C.

It is respectfully submitted that it is critical to the present invention that the process is conducted at a temperature above 35°C. Indeed, it has been unexpectedly found that the reaction of dichloromonophenyl phosphate and monochlorodiphenyl phosphate with an aliphatic alcohol, in the presence of a Lewis acid catalyst, in the absence of solvent, at a temperature of above 60 to 200°C, and at a pressure of 0.001 to 1.1 bar absolute pressure (bara) produces a product having a higher purity than would have been expected. That is, as shown in the application, particularly, in Table 1, example 3 conducted at a temperature of 120°C and at 150 mm Hg and example 4 conducted at a temperature is 120°C and at 50 mm Hg have a calculated reaction yield (upon adding TTP, 2-ethylhexyldiphenyl phosphate and 2-ethylhexylphenyl phosphate) of 94.4% and 97.4% respectively. In stark contrast, the reaction process recited in Hardy conducted at a temperature below 35°C, so as to avoid by-product, has a yield of 77% and 82% (when 2 molar excess of alcohol is used). Therefore, conducting the claimed process at a temperature of 60 to 200°C unexpectedly produces a more purified product mixture.

To demonstrate the criticality of conducting the process of the present invention at a temperature above 35°C, the Applicants provide the Declaration of Andrew M. Piotrowski, a Scientist for the assignee of the priority patent and the present application, under 37 CFR §1.132 annexed hereto which includes

“a side-by-side comparison of the product yield of the process [of the present invention] and that of the prior art at the same reaction temperature and concentration” as requested by the Examiner. (Office Action, page 3). Indeed, the Examiner has acknowledged Applicants’ argument that the claimed process produces unexpected results, but rejected the argument without a side-by-side comparison of the product yield of the claimed process and that of the prior art process at the same reaction temperature and concentration.

Accordingly, three experiments were conducted to provide a direct comparison of the product yield of the process of the present invention and the product yield of the process disclosed in Hardy at the same temperature and concentration. The three experiments conducted show a side-by-side comparison between the claimed process for producing alkylphenyl phosphates comprising the steps the present invention which involves reacting a dichloromonophenyl phosphate and monochlorodiphenyl phosphate with an aliphatic alcohol, in the presence of a Lewis acid catalyst, in the absence of solvent, at a temperature of above 60 to 200° C, and at a pressure of 0.001 to 1.1 bar absolute pressure (bara) (experiment 3); and the process described in Hardy (experiments 1 and 2).

Experiment 1 was conducted using 2-ethyl hexanol at a temperature of 20°C using the same ratio of alcohol as used in the claimed invention. It is noted that Hardy used 100% excess of alcohol to shorten the reaction time and improve yield. As shown in this experiment conducted without excess alcohol, it took more than 30 hours to get a yield of about 84.3 percent. (See, Piotrowski Declaration, Table 1).

When the same reaction was conducted at a higher temperature (experiment 2), namely 120°C, the reaction was faster but the yield was lower (79.3 percent) due to by-product formation. (See, Piotrowski Declaration, Table 1). Further analysis indicates that not only is the yield less pure but the reaction mixture contains significant formation of alkyl chloride which is very undesirable since alkyl chloride is very hard to dispose of chemically. Therefore, experiment 2, which was conducted at a higher temperature and without vacuum, as described in the Hardy reference, produced a less desirable product mixture having more by-products. This is consistent with the description in Hardy.

In stark contrast, experiment 3, which is taken directly from the table in experiment 4 of the specification, and was run at the claimed temperature of 120°C under vacuum, yielded a much higher yield than experiments 1 and 2 following the Hardy teachings. That is, Experiment 3 following the inventive conditions produced over 97 percent product in about 4 hours with much less by-products. (See, Piotrowski Declaration, Table 1). Less by-products make the process more cost effective and efficient since less purification is needed and less disposal of harmful chemicals.

Accordingly, as shown by the side-by-side comparison of the process run under the Hardy conditions (experiments 1 and 2) and the process run according to the claimed conditions (experiment 3), the temperature used is shown to be critical in producing the claimed process wherein the yield is higher and is done without excess alcohol. This data is provided to support the Applicants' arguments provided in the previous response, which the Examiner believes "would make the applicants' argument convincing." (Office Action, page 3). In

view of the foregoing, and in line with the teachings of Hardy, one skilled in the art would not have changed the reaction temperature from 20°C as taught by Hardy to above 60°C to 200°C as claimed.

Accordingly, carrying out the reaction under the conditions of the present invention unexpectedly produces a more purified product mixture at the same reaction temperature and concentration. In that Hardy in view of Giolito neither teaches nor suggests the process as claimed, the rejection of Claims 1-10 and 14-20 under 35 U.S.C. §103(a) must reconsidered and withdrawn. By way of this amendment claims 13 and 21 have been cancelled and therefore the rejection of these claims is now moot.

In the Office Action, Claims 1-10 and 13-21 have been rejected under 35 U.S.C. §112, second paragraph, as allegedly being indefinite for allegedly failing to particularly point out and distinctly claim the subject matter which the Applicants regard as their invention. In particular, the Examiner has stated that the claims recite “a process comprising” and “a two-step process” and “[i]t is not clear what process or what two-step process Applicants are claiming.” (Office Action, pages 4-5).

Accordingly, in order to clarify what process Applicants are claiming, by way of this amendment Claim 1 has been amended so as to further define the process as a “process for producing alkylphenyl phosphates comprising . . .” Since Claims 2-10 and 14-20 depend either directly or indirectly from Claim 1, these claims also include this clarification.

Furthermore, in order to clarify what two-step process Applicants are claiming, Claim 5 has been amended herein to recite “[a] two-step process to

prepare a mixture of monoalkyl diphenyl phosphates and dialkyl monophenyl phosphates wherein phosphorus oxychloride is reacted with phenol in a first step resulting in a mixture of diphenyl monochlorophosphates and monophenyl dichlorophosphates; and the mixture of diphenyl monochlorophosphates and monophenyl dichlorophosphates resulting from the first step is reacted with an aliphatic alcohol in a second step, in accordance with the process according to claim 1.” Since Claims 6-8 and 17-19 depend either directly or indirectly from Claim 5, these claims also include this clarification.

In view of the foregoing, it is respectfully submitted that the rejection of Claims 1-10 and 14-20 under 35 U.S.C. §112, second paragraph, as allegedly being indefinite must be reconsidered and withdrawn. By way of this amendment claims 13 and 21 have been cancelled and therefore the rejection of these claims is now moot.

Finally, Claims 13 and 21 have been objected to as allegedly including new matter. The Applicants respectfully disagree. However, in order to advance the prosecution of the instant application, Applicants have cancelled Claims 13 and 21.

Accordingly, in view of the forgoing amendment and accompanying remarks, it is respectfully submitted all claims pending herein are in condition for allowance. Please contact the undersigned attorney should there be any questions.

Early and favorable consideration of the case is respectfully requested.

Respectfully submitted,

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